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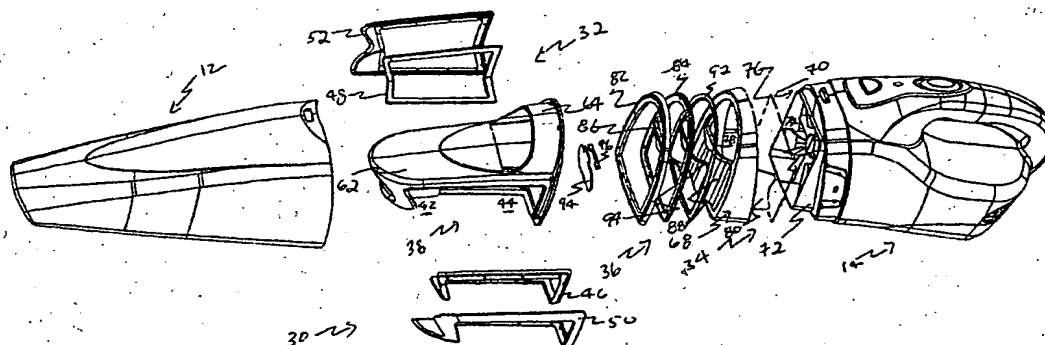
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(54) Title: **DUAL FILTER WET/DRY HAND-HELD VACUUM CLEANER**



(57) Abstract: A dual filter wet/dry hand-held vacuum cleaner (12) includes a two-stage filtration system effective to provide liquid and/or dry pickup while minimizing the frequency with which it needs cleaned out that, at cleanup time, may be cleaned efficiently with little or not dust generation and minimal or no direct contact with accumulated grime.

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DUAL FILTER WET/DRY HAND-HELD VACUUM CLEANER

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FIELD OF THE INVENTION

This invention is drawn to the field of vacuum cleaners, and more particularly, to a novel dual filter wet/dry hand-held vacuum cleaner.

10

BACKGROUND OF THE INVENTION

15

Wet/dry hand-held vacuum cleaners are portable devices useful in home, office and other environments to provide pick-up of dirt and/or liquid spillage. When not in use, they are typically stored, together with any accessories, on a recharging base unit. USP 4,831,685 issued May 23, 1989 to Bosyjl et al., incorporated herein by reference, is exemplary of the heretofore known wet/dry hand-held vacuum cleaners.

20

The more times they are used, and the longer they are operated each time, the greater is the dirt and/or liquid spillage that accumulates therewithin until the point is reached beyond which the cleaning power of the units is noticeably reduced. At each such time, whether after multiple small cleaning jobs or during a single large one, the units must be emptied of the accumulated grime.

25

Wet/dry hand-held vacuum cleaners are thus called upon to provide filtration effective to accumulate solid and liquid matter, to provide such filtration for as long as possible before their cleaning power is noticeably reduced and, at the times of emptying, to provide efficient clean-up.

SUMMARY OF THE INVENTION

Accordingly, it is the principal object of the present invention to disclose a novel dual filter wet/dry hand-held vacuum cleaner effective to provide liquid and/or dry pick-up while minimizing the frequency with which it needs cleaned out that, at cleanup time, may be cleaned efficiently with little or no mess.

The dual filter wet/dry hand-held vacuum cleaner of the present invention includes a powered unit; an elongated dust bowl removably attached to the powered unit having an intake nozzle that discharges a stream in which dirt and/or liquids may be entrained; a first filter mounted in the dust bowl that receives the intake nozzle stream and discharges filtered air from which liquids and comparatively-large particulates that may be present in the intake nozzle stream have been separated; and a second filter intermediate the first filter and the powered unit that receives the filtered air from the first filter and discharges purified air from which comparatively-small particulates that may be present in the

filtered air have been separated. The dual filter wet/dry hand-held vacuum cleaner of the present invention in this manner provides effective filtration of liquids and solids and thereby provides clean, healthy environments that are

5 substantially free of dirt, dust, allergens and bacteriological pollutants.

Because the first filter separates liquids and such comparatively-large particulates as dirt particles, lint, hair and dead skin from the intake nozzle stream, the second filter

10 is allowed to remove such comparatively-small particulates as pollen, other allergens and fine dust from the filtered air without becoming clogged by comparatively-large particulates, which maximizes the collection efficacy of the second filter and therewith minimizes the frequency with which it needs

15 cleaned or replaced.

The first filter preferably includes a frame slidably mounted in the dust bowl that is substantially coextensive with a major portion thereof. The frame substantially coextensive with the dust bowl maximizes the particulate

20 trapping capacity of the first filter and therewith minimizes the frequency when it needs to be cleaned out.

The frame of the first filter preferably has top, and open bottom, side and end walls that bound an interior volume. One end wall is adapted to receive the intake nozzle so that

25 it opens into the interior volume of the frame of the first filter. Metallic screens are mounted to the open side and

bottom walls that separate comparatively-large particulates and liquids from the intake nozzle stream, and the other open end wall of the frame provides a discharge end. At emptying time, the accumulated dirt may be discharged from the interior
5 volume and through the open discharge end of the frame of the first filter directly into a suitable trash receptacle, which minimizes dust generation and direct user contact with dirt. Any liquid that passes through the side and bottom screens is accumulated in the dust bowl, which, at cleanup time, may be
10 separately discharged by emptying the dust bowl into a suitable liquid receptacle.

The second filter preferably includes a cover removably attached to the powered unit; a flange providing a flat filter mounting recess formed about the dust bowl receiving face of
15 the powered unit; and one of a foamed plastic flat filter, a HEPA flat filter and a ULPA flat filter that is removably mounted to the mounting recess of the powered unit. At cleaning or replacement times, the flat filter mounted in the filter mounting recess may be readily removed, and cleaned or
20 replaced.

Any suitable filter arrangement to separate comparatively-large and comparatively-small particulates from the intake nozzle stream and any suitable seal arrangement to provide fluid-tight first and second filter fluid
25 communication and to prevent dirt and liquid ingress from the dust bowl to the powered unit may be employed.

BRIEF DESCRIPTION OF DRAWINGS

These and other objects, inventive aspects, and advantageous features of the present invention will become
5 apparent as the invention becomes better understood by referring to the following solely exemplary detailed description of the presently preferred embodiments thereof, and to the drawings, wherein:

Figure 1 is a perspective view showing a presently
10 preferred embodiment of a dual filter wet/dry hand-held vacuum cleaner in accord with the present invention;

Figure 2 is an exploded perspective view of the dual filter wet/dry hand-held vacuum cleaner of Figure 1;

Figure 3 is an end view of the frame of the first filter
15 of the dual filter wet/dry hand-held vacuum cleaner of the present invention; and

Figure 4 is a longitudinal section taken along the lines
4-4 of Figure 1 useful in explaining the operation of the dual
20 filter wet/dry hand-held vacuum cleaner in accord with the present invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Referring now to Figure 1, generally designated at 10 is
25 a perspective view showing a presently preferred embodiment of the dual filter wet/dry hand-held vacuum cleaner in accord

with the present invention. The dual filter wet/dry hand-held vacuum cleaner 10 includes an elongated dust bowl generally designated 12 having an intake nozzle at the proximate end thereof and a powered unit generally designated 14 having a dust bowl receiving face to which the dust bowl 12 is removably attached. The powered unit 14 includes a handle member 16, and a dust bowl release button 18. A power switch 20 is operatively connected in well-known manner to a rechargeable battery that powers a motor whose shaft turns a vacuum impeller blade, all not shown, that are mounted in the powered unit. An easy-to-clean, two-stage filter to be described intermediate the intake nozzle and powered unit effectively removes dirt and/or liquids that may be entrained in the intake nozzle stream and discharges purified air cleaned of comparatively-large and comparatively-small particulates through an exhaust vent, not shown, into the ambient air. The wet/dry hand-held vacuum cleaner 10, when not in use, is stored on a base that recharges the battery, and stows any accessories, not shown.

Referring now to Figure 2, generally designated at 30 is an exploded perspective view of the dual filter wet/dry hand-held vacuum cleaner of the present invention. The vacuum cleaner 30 includes a first filter subassembly generally designated 32 slidably mounted in the dust bowl 12 and a second filter subassembly generally designated 34 intermediate the first filter 32 and the powered unit 14. The first filter

32 receives the inlet nozzle stream and discharges an air stream from which liquids and comparatively-large particulates have been separated, and the second filter 34 receives the air stream out of the first filter and discharges purified air
5 cleaned of comparatively-small particulates.

A sealing subassembly generally designated 36 intermediate the confronting ends of the first and second filters 32, 34 prevents dirt and liquid ingress from the dust bowl 12 into the powered unit 14 and joins the first and
10 second filters subassemblies 32, 34 in fluid-tight fluid communication. Any suitable first and second filters respectively providing comparatively-large and comparatively-small particulate's removal, and any sealing arrangement suitable to prevent dirt and liquid ingress while providing
15 fluid-tight fluid communication between the filters, may be employed without departing from the inventive concepts.

The first filter subassembly 32 includes an elongated frame generally designated 38 having top, and open bottom, side and end walls that bound an internal volume generally
20 designated 40 as best seen in Figure 3. As best seen in Figure 4, the first filter 32 is substantially coextensive with a major portion of the dust bowl 12, which maximizes the particulate trapping capacity of the first filter and therewith minimizes the frequency with which it needs to be
25 cleaned out.

In the open side and bottom walls generally designated 42, 44 are mounted metallic screens 46, 48 having a L-shaped cross-section, which are captured between screen support frames 50, 52, also having a L-shaped cross-section, and the frame member 38. The screen support frames 50, 52 may be adhesively, threadably, ultrasonically welded or otherwise fastened to the frame 38, and preferably are threadably fastened thereto. While L-shaped metallic screens 46, 48 of pore sizes between 0.3mm to 0.5 mm which may vary smaller and larger dependent on the specific application requirements are presently preferred, any screening material of any configuration selected to trap comparatively-large particulates within the internal volume of the frame while passing comparatively-small particulates and liquids therethrough may be employed.

The frame 38 of the first filter 32 is provided with an open end generally designated 54, best seen in Figure 3, that is adapted to receive intake nozzle 58 of dust bowl 12 as illustrated in Figure 4. A peripheral flange 60 transversely extends from the other open end of the frame member 38 as is best seen in Figure 3. The flange 60, together with the end of top wall 62 of the frame member 38, define an opening generally designated 64 best seen in Figure 3 through which particulates trapped in the internal volume 40 of the frame 38 may be efficiently discharged at the time of emptying into a

suitable trash receptacle with little or no direct contact with the accumulated grime and little or no dust generation.

An arcuate wall 64 joined at the sides to the top wall 62 longitudinally extends from the flange 60 towards the open
5 nozzle end 54 of the frame 38 of the first filter subassembly 32. The arcuate wall 64, together with the confronting surface of the top wall 62, define a duct generally designated 66 best seen in Figure 3 through which filtered air passes from the first filter 32 into the second filter 34.

10 The second filter subassembly 34 includes a cover member generally designated 68 removably attached to the dust bowl receiving face generally designated 70 of the powered unit 14; a flange 72 providing a flat filter mounting recess generally designated 74 peripherally formed about the dust bowl
15 receiving face 70 of the powered unit 14; and one of a foamed plastic, a HEPA, and UPLA flat filter shown in dashed outline 76 that is removably mounted to the mounting recess 74 of the powered unit 14. Although a second filter subassembly 34 that includes a flat filter 76 is presently preferred, any second
20 filter subassembly that is adapted to remove comparatively-small particulates may be employed.

The cover 68 of the second filter 34 includes an opening generally designated 78 that is registered with the duct 66 of the first filter 32, and has longitudinally extending side
25 arms 80 that releasably resiliently engage the confronting

sides of the powered unit 14, although any means for removably attaching the cover 68 to the powered unit 14 may be employed.

As will be readily appreciated, cleaning or replacement of the second filter is efficient and straightforward. At
5 cleaning or replacement times, which are infrequent, since the second filter only removes comparatively-small particulates, which typically accumulate slowly over time, the cover member is released from the powered unit to expose the flat filter mounted in the filter mounting recess, which then may be
10 readily removed. After it is cleaned, it is placed back in the mounting recess, or it may be replaced by another flat filter of the same or different type, after which the cover is reattached to the powered unit.

The sealing subassembly 36 includes a rubber seal member
15 82, captured by seal retainer frame 84, mounted to the flange 60 of the frame 38 of the first filter subassembly 32. The seal retainer frame 84 may be adhesively, threadably, ultrasonically welded or otherwise fastened to the flange 60, and preferably is threadably fastened thereto. The rubber
20 seal member 82 prevents liquid and dirt ingress from the dust bowl 12 to the powered unit 14 as best seen in Figure 4. While ring seal 82 is presently preferred, any peripheral seal arrangement adapted to prevent liquid and dirt ingress from the dust bowl to the powered unit may be employed.

25 The seal retainer frame 84 includes a transverse rib 86 that seats in the top of the open end 64 of the frame member

38 of the first filter subassembly 32 and provides a finger pull, which aids in slidably removing the first filter 32 from the dust bowl 12 at times of emptying, as best seen in Figure 4.

5 The sealing subassembly 36 includes a rubber sealing pad 88 mounted to the outside face of the cover 68 of the second filter subassembly 34 that is of a width and height just larger than the width and height of the opening of the open end wall 64 of the frame 38 of the first filter 32. Although
10 a rubber seal pad 88 is preferred, any suitable seal arrangement adapted to prevent dirt and liquid ingress from the open end 64 of the first filter 32 to the second filter subassembly 34 may be employed.

15 The sealing subassembly 36 further includes a rubber seal member 92 adhesively mounted to the outside face of the cover member 68 of the second filter 34 that has a rubber transverse seal member 94 in registration with both the end wall of the top 62 of the frame 38 of the first filter 32 and with the
20 transverse rib 86 of the seal retainer frame 84 as best seen in Figure 4. While ring seal member 92 with transverse seal member 94 adhesively mounted to the cover 68 of the second filter subassembly 34 is presently preferred, any seal arrangement adapted to peripherally seal the confronting ends of the first and second filter subassemblies and of the duct
25 and registered opening thereof may be employed.

A flap 94, retained by fastener 96, is pivotally mounted to the distal end of the inlet nozzle, which acts as a one-way valve, allowing air and entrained dirt and liquids to enter the interior volume of the first filter while preventing entrapped particulates from exiting out the inlet nozzle as best seen in Figure 4.

In operation, and referring now to Figure 4, inlet air schematically illustrated by arrow 98 that may have entrained liquids and particulates is discharged into the interior volume 40 of the first filter subassembly 32. The first filter 32 discharges an airstream schematically illustrated by arrows 100 from which liquids and comparatively-large particulates have been separated. As will readily be appreciated, any liquids in the inlet nozzle stream are collected in the bottom of the dust bowl 12. The airstream 100 flows through the duct 66 and the registered opening 78 into the second filter subassembly 34, where the flat filter removes comparatively-small particulates therefrom. The powered unit 14 exhausts purified air cleaned of liquids, comparatively-large particulates and comparatively-small particulars as schematically illustrated by arrows 102.

Many embodiments, variations and modifications of the presently disclosed invention will become apparent to those of skill in the art without departing from the inventive concepts.

WHAT IS CLAIMED IS:

1 1. A dual filter wet/dry hand-held vacuum cleaner,
2 comprising:
3 a powered unit having a suction face;
4 an elongated dust bowl removably attached to the powered
5 unit having an intake nozzle in fluid communication with the
6 suction face that discharges a stream in which dirt and/or
7 liquid may have been entrained;
8 a first filter subassembly mounted in the dust bowl that
9 receives the intake nozzle stream and discharges filtered air
10 from which liquids and comparatively-large particulates that
11 may be present in the intake nozzle stream have been
12 separated; and
13 a second filter subassembly intermediate the first filter
14 subassembly and the suction face of the powered unit that
15 receives said filtered air and removes comparatively-small
16 particulates that may be present therein.

1 2. The dual filter wet/dry hand-held vacuum cleaner of claim
2 1, further including at least one seal member intermediate
3 said first and said second filter subassemblies that prevents
4 dirt and liquid ingress from the first filter subassembly into
5 the second filter subassembly while joining the first and
6 second filter subassemblies in fluid-tight fluid
7 communication.

1 3. The dual filter wet/dry hand-held vacuum cleaner of claim
2 1, wherein the first filter subassembly includes a frame
3 member slidably mounted in the dust bowl that is substantially
4 coextensive with a major portion of the dust bowl, which
5 maximizes the particulate trapping capacity of the first
6 filter subassembly and therewith minimizes the frequency with
7 which it needs to be emptied of accumulated grime.

1 4. The dual filter wet/dry hand-help vacuum cleaner of claim
2 1, wherein the frame member has top, open bottom, and open
3 side and end walls that bound an interior volume; wherein
4 screens are mounted to the open side and bottom walls to
5 separate comparatively-large particulates and liquids from the
6 intake nozzle stream; wherein one open end wall of the frame
7 member is adapted to receive the intake nozzle so that it
8 discharges into the interior volume of the frame member of the
9 first filter subassembly; and wherein the other open end wall
10 of the frame member permits, at emptying time, any accumulated
11 comparatively-large particulates to be discharged through that
12 open end of the frame member directly into a suitable trash
13 receptacle, which minimizes dust generation and direct user
14 contact with dirt.

1 5. The dual filter wet/dry and-held vacuum cleaner of claim
2 1, wherein the second filter subassembly includes a cover
3 member removably attached to the suction face of the powered
4 unit; a flange providing a flat filter mounting recess formed
5 about the suction face of the powered unit; and one of a
6 foamed plastic flat filter, a HEPA flat filter, and a ULPA
7 flat filter that is removably mounted to the mounting recess
8 of the powered unit.

1 6. Cleaning apparatus that provides effective filtration of
2 comparatively-large and comparatively-small particulates,
3 comprising:

4 a vacuum cleaner having an inlet opening and an outlet
5 opening connected by an inline throughflow passage; and
6 a two-stage filter intermediate the inlet opening and the
7 outlet opening, the first stage of said two-stage filter
8 includes a first, stationary flow-through filter arranged in
9 an upstream part of the throughflow passage that is adapted to
10 remove comparatively-large particulates entering the vacuum
11 cleaner by way of the inlet opening but to allow
12 comparatively-small particulates to pass thereinthrough, and
13 the second stage of said two-stage filter includes a second,
14 stationary flow-through filter arranged in a downstream part
15 of the throughflow passage that is adapted to remove
16 comparatively-small particulates entering the second stage

7 from the first stage and to exhaust through the outlet opening
18 purified air cleaned of comparatively-small particulates.

1 7. The cleaning apparatus of claim 6, wherein said vacuum
2 cleaner is a hand-held vacuum cleaner having a removably
3 attachable dust bowl and said inline throughflow passage is
4 provided by said dust bowl.

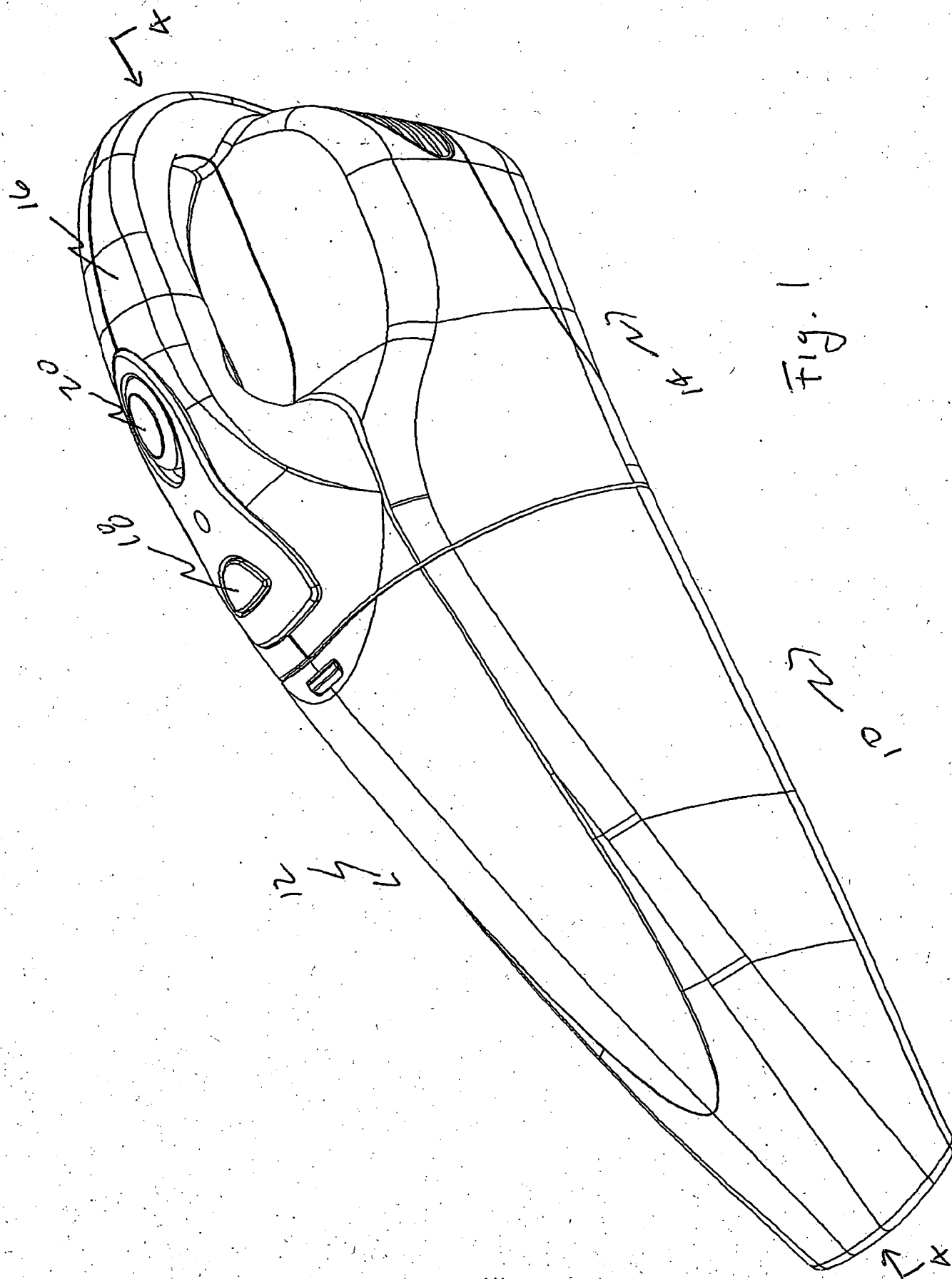
1 8. The cleaning apparatus of claim 6, wherein said vacuum
2 cleaner is a wet/dry hand-held vacuum cleaner.

1 9. The cleaning apparatus of claim 7, wherein said stationary
2 flow-through filter of said first stage of said two-stage
3 filter includes a frame member having walls bounding an
4 internal volume at least one of which is screened behind which
5 said comparatively-large particulates are trapped in said
6 internal volume but which passes said comparatively-small
7 particulates.

1 10. The cleaning apparatus of claim 7, wherein said
2 stationary second flow-through filter of said second stage of
3 said two-stage filter is a foamed plastic flat filter element.

1 11. The cleaning apparatus of claim 7, wherein said
2 stationary second flow-through filter of said second stage of
3 said two-stage filter is a HEPA flat filter element.

1 12. The cleaning apparatus of claim 7, wherein said
2 stationary second flow-through filter of said second stage of
3 said two-stage filter is a ULPA flat filter element.



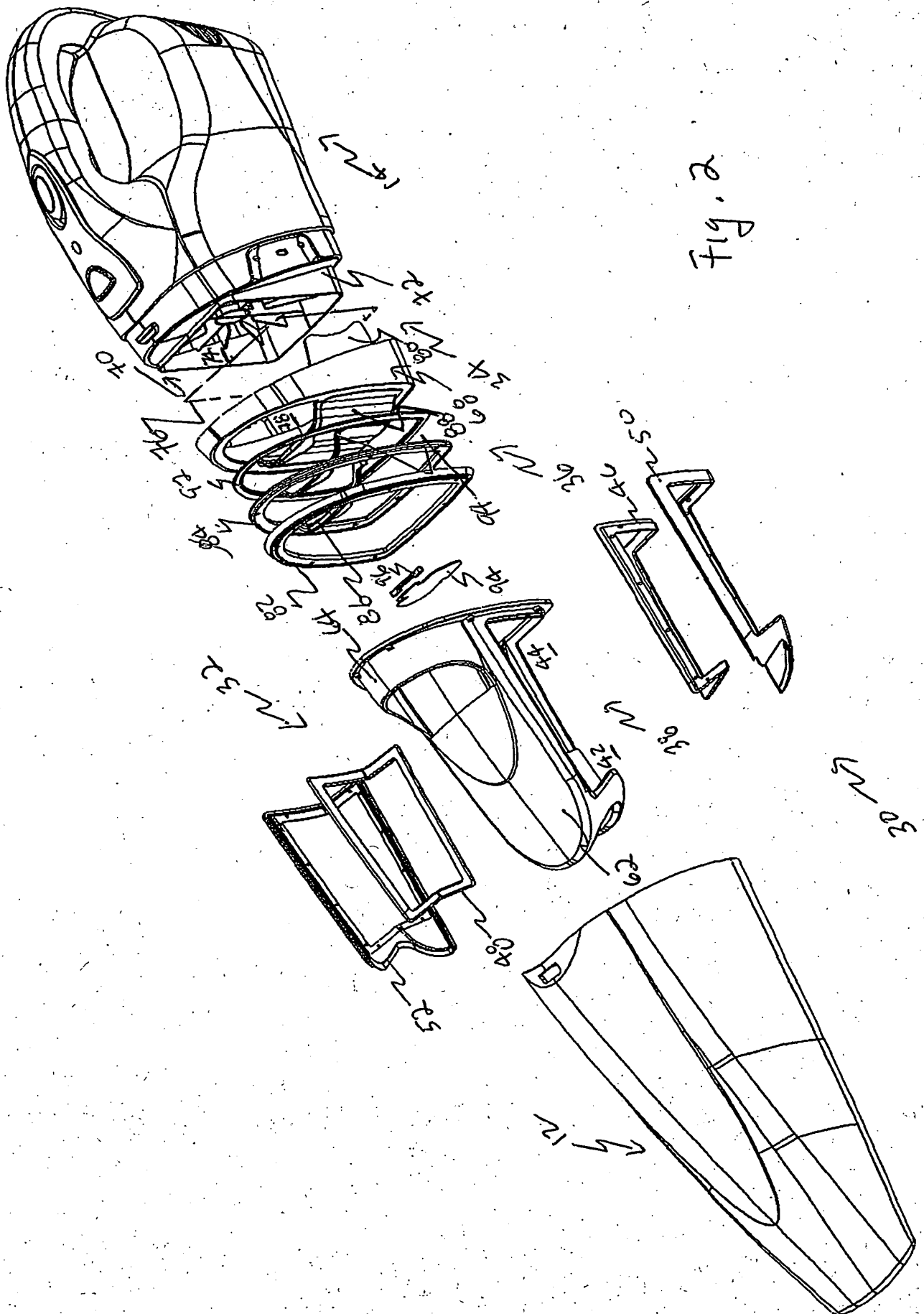
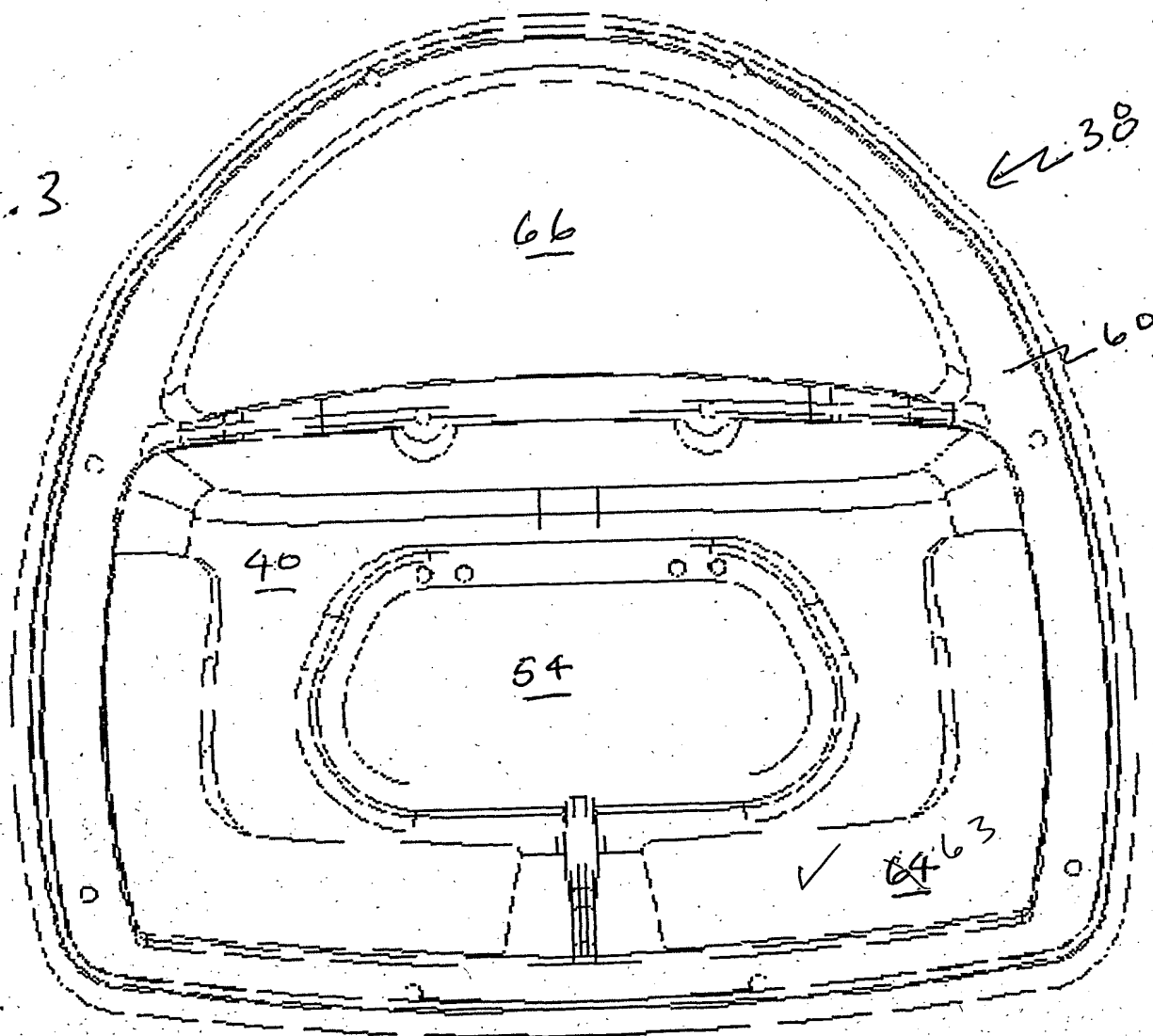


Fig. 3



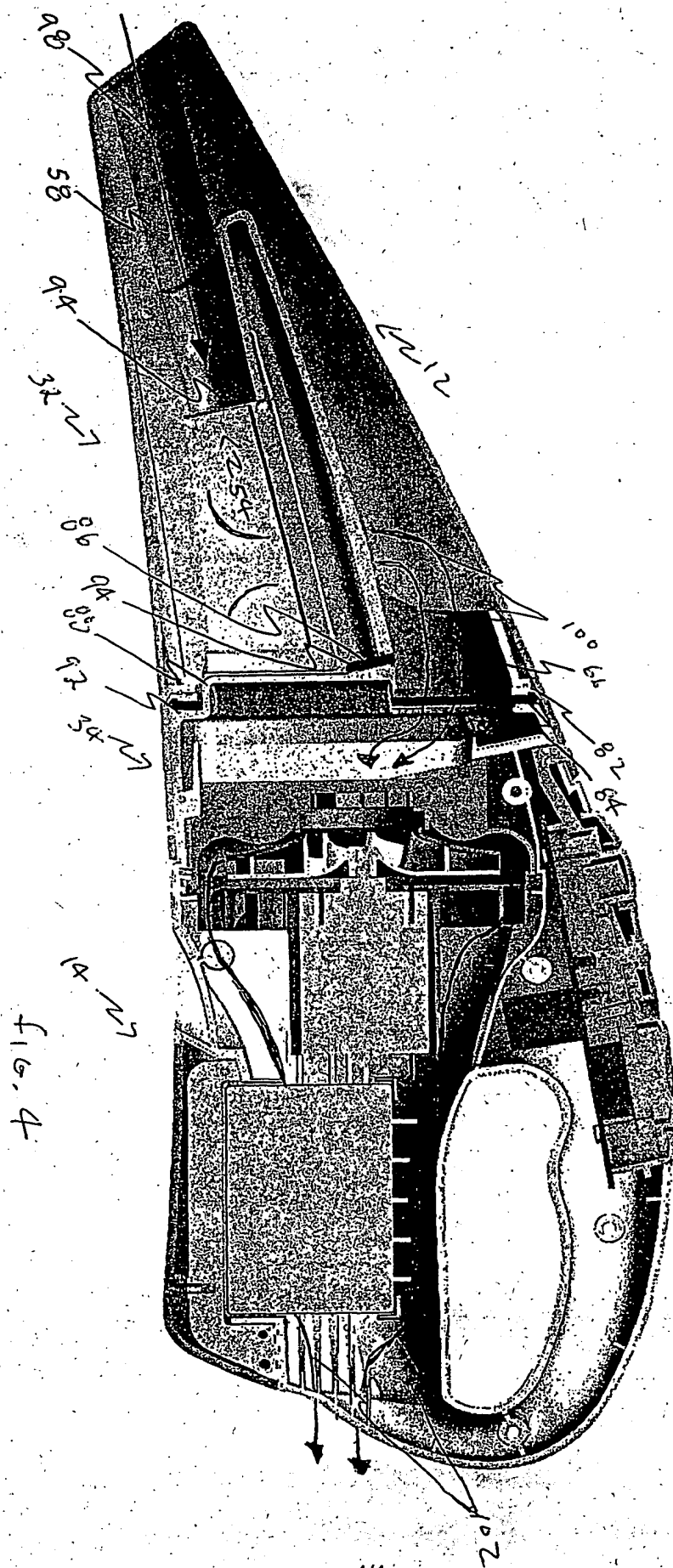


fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/11264

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A47L 5/24
US CL : 15/344, 352

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 15/344, 352

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,020,187 A (KOSTEN ET AL) 04 JUNE 1991(04.06.1991), see entire document.	1,3,6,7,8
X	US 4,821,366 A (LEVINE) 18 APRIL 1989(18.04.1989), see entire document.	1,2,5,6,10
X	US 4,213,224 A (MILLER) 22 JULY 1980 (22.07.1980), see entire document.	1,6
A	US 4,831,685 A (BOSYJ ET AL) 23 MAY 1989 (23.05.1989), see entire document.	1-12
A	US 4,924,548 A (TOUYA ET AL) 15 MAY 1990 (15.05.1990), see entire document.	1-12
A,P	US 6,125,501 A (YIP) 03 OCTOBER 2000 (03.10.2000), see entire document.	1-12

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